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OPERATIONAL EFFICIENCY AND SIZE OF COMMERCIAL BANKS: A STUDY OF THE INDIAN BANKING SECTOR

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ABSTRACT

This study attempts to find out the association between the size of a bank and its efficiency on the basis of the Indian scheduled commercial banking sector for the time period 2006-2016. Size of banks has been measured by two variables – total asset of the bank and the number of branches of the bank. Operational efficiency has been estimated by applying the Data Envelopment Analysis. To check the robustness of our results, the study has been performed with respect to the cost efficiency of the banks as well. We found that in India, there is a strong positive association between the size of the bank and efficiency. Larger banks (measured in terms of log value of total asset and number of branches in the country) in India are more efficient both in terms of technical and cost efficiency. The study also revealed that the large-sized public sector banks are the most efficient banks in spite of their large size both in terms of total asset and massive branch network across the country.

KEYWORDS: *Data Envelopment Analysis, Efficiency, Bank Size, Financial Inclusion, Indian Commercial Banks*

INTRODUCTION

For a long period of time, India's financial system has been primarily dominated by banks, mainly public sector banks. The public sector banks control about 70 per cent of the total banking asset in the country and they have been acting as the main lending agent for general mass in India, while the private and foreign banks are basically oriented towards adoption of new technology in banking business, introducing sophisticated financial tools and catering to the urban customers. Initially, India started its economic journey as a relatively closed economy with significant state intervention in industrial licensing policy and considerable control over private investment. However, after the economic crisis of the early 1990s, revolutionary reforms were implemented in the banking sector to improve the financial health of the commercial banks in terms of capital adequacy, profitability and asset quality, keeping in pace with the overall economic reforms initiated in the country. After implementation of the banking sector reforms, there have been considerable improvements in the asset quality, efficiency, performance indicators and risk management of state-owned banks improved as suggested by numerous studies [Sathye (2003), Shanmugam et al (2004), Das et al (2005), Bonin et al (2005), Das et al (2012)]. But the financial reforms have failed to solve the most severe problem of the Indian financial system, which is inaccessibility to basic banking services for a large number of people, particularly for those living in rural and hilly areas. Even after considerable improvements in efficiency, productivity, and profitability, the goal of financial inclusion was far from

satisfactory. Hence, following the recommendations of the Rangarajan Committee, at the beginning of this decade, the banking policymakers and authorities had to adopt a series of policies focused on financial inclusion. These policies called for branch expansion in rural or unbanked areas, provision of basic savings account and adequate credit at affordable costs to the people of lower income group. The agenda of financial inclusion called for massive geographical and financial expansion of most public sector banks following the opening of numerous new branches and savings accounts and in the last decade. The size of the commercial banks augmented manifold both in terms of the number of branches and total business as a result of an increased number of savings or credit accounts.

This spectacular growth of the financial activities by commercial banks in India has initiated a new debate. The conventional wisdom argues that large banks are more efficient as they are more likely to reap the benefits of scale and scope economics and have a competitive advantage over the smaller counterparts [Inanogluet al (2016)]. But this conventional approach has an alternate view suggesting large banks are actually inefficient and problematic for policy makers and regulators due to various reasons such as the tendency to take excessive credit risks, systematic risks and downfall in managerial efficiencies due to the geographical distance between bank offices. Although a series of reforms including implementation of strong capital adequacy norms, limiting the scope of banking activities, additional scrutinizing of the proposals for mergers and acquisitions or breaking up weak banks has been suggested to solve these problems, these have their own detractors. The past investigations regarding the relationship between bank size and efficiency around the world brought mixed results [Clark (1996), Camanho et al (1999), Altunbas et al (2001), Girardone et al (2004), Qayyum et al (2006), Inanogluet al(2016)]. Some financial economists have proposed a theory of determining the optimal size of a banking firm [Krasa et al (1992)]. Ray (2007) proposed the concept of “size efficiency” distinct from scale efficiency and applied it in his study on the Indian banking sector to find out whether some ofthe Indian banks are too large to be optimally efficient. Therefore, we can infer that the relationship between the size of the bank and its efficiency is not free from ambiguity. Moreover, most of these studieshaveconsidered the banking sector of the developed economies. Very little focus has been conveyed towards the analysis of the association between bank size and performance of banks in the perspective of the emerging economies. This study aims at investigating the relationship between bank size and their efficiency with respect to the Indian banking scenario. This study attempts to find out whether the larger banks in India are more efficient than the smaller banks.

DATA AND METHODOLOGY

The study period runs from 2006 to 2016 to capture the phase of enormous financial and geographical expansion of the Indian banking sector. The entire Indian commercial banking sector, comprising of the public sector, domestic private sector and foreign banks have been taken into account in this study to make it more comprehensive. However, the number of banks varies for different years due to the opening of new banks, closure of an existing bank, mergers or acquisitions those have taken place during the study period. Some banks have also been omitted from the final data set due to the unavailability of some data. Bank-wise unbalanced panel data of all scheduled commercial banks of India during the time period 2005-06 to 2015-16 has been collected from various issues of Reserve Bank of India publications - ‘Statistical Tables Relating to Banks in India’ and ‘Report of Trend and Progress of Banking in India’. To analyze the association between bank and efficiency, it is important to specify the definition of bank size. In this study, we have measured the “size” of the commercial banks by two variables – the (log of) total asset of the banks and the number of branches of the banks. This has also helped to check the robustness of our results. Similarly, both technical and cost efficiencies have been

used separately as performance indicators of banks. Technical and cost efficiency scores have been estimated using the non-parametric method, Data Envelopment Analysis (DEA). DEA is a linear programming based technique that estimates relative efficiencies of a fairly homogeneous set of "decision-making units (DMUs)" those produce multiple outputs using multiple inputs. Production frontier is constructed using Linear Programming method by identifying some "best practice" DMUs based on observed level of pre-determined input and output bundle, their market prices and some specifications regarding the production technique. We can estimate technical, cost, profit or revenue efficiencies of the DMUs with respect to the frontier constructed by the "best practice" DMUs. The primary methodology of this study is based on the pioneering work by Ray (2004). There are various models of DEA depending on the specification of technology used to estimate the best-practice frontier. This study has applied the output-oriented non-radial CCR-DEA model. We have estimated non-radial Pareto-Koopmans technical efficiency scores those are free of input or output slacks. Let us briefly discuss the DEA model used in this paper.

If we have a sample of 'N' firms from an industry producing 'm' outputs from 'n' inputs, $x^j = (x_{1j,}\ x_{2j},....., x_{nj})$ is the input bundle of firm 'j', $(j = 1,2,....., N)$ and $y^j = (y_{1j,}\ y_{2j},....., y_{mj})$ is the observed output bundle, a non-radial Pareto-Koopmans measure of technical efficiency of DMU_0 can be computed by solving the LP problem:

$$\text{Min } \tilde{\Gamma} = \frac{1}{n}\sum_{i=1}^{n}\theta_i - \frac{1}{m}\sum_{r=1}^{m}\phi_r$$

Subject to,

$$\sum_{j=1}^{N}\lambda_j y_{rj} \geq \phi_r y_{r0}; \qquad r = 1, 2\ldots m;$$

$$\sum_{j=1}^{N}\lambda_j x_{ij} \leq \theta_i x_{i0}; i = 1, 2\ldots n;$$

$$\phi_r \geq 1; \qquad r=1, 2\ldots m$$

$$\theta_i \leq 1; \qquad i = 1, 2\ldots n;$$

$$\sum_{j=1}^{N}\lambda_j = 1;\ \lambda_j \geq 0; \qquad j = 1, 2\ldots N$$

Once we obtain the optimal (θ^*, ϕ^*) from this problem, the Pareto-Koopmans efficiency is measured by,

$$\Gamma^* = \frac{1}{n}\sum_{i=1}^{n}\theta_i\ */\ \frac{1}{m}\sum_{r=1}^{m}\phi_r\ *$$

In our study, we have estimated this "Pareto-Koopmans" efficiency of banks.

The cost efficiencies have also been estimated using output-oriented CCR-DEA model. The firm is assumed to be the price taker in the input market. We need find to out the minimum cost at the given input prices and production

possibility set to produce the specific level of output. Then we can estimate the cost efficiency of a specific firm relative to the minimum cost. We consider a set-up of 'N' firms, 'n' inputs and 'm' outputs. Then for a target output bundle $y^0$and at given input price vector w^0, the minimum cost of each bank under VRS technology is derived by solving the following linear programming problem:

$$\text{Min} \quad \sum_{i=1}^{n} w_i^0 x_i$$

Subject to

$$\sum_{j=1}^{N} \lambda_j x_{ij} \leq x_i \quad i = 1, 2, \ldots, n;$$

$$\sum_{j=1}^{N} \lambda_j y_{rj} \geq y_{r0} \quad r = 1, 2, \ldots, m;$$

$$\sum_{j=1}^{N} \lambda_j = 1$$

$$\lambda_j \geq 0 \qquad j = 1, 2, \ldots, N$$

The optimal solution of this problem yields the cost-minimizing input bundle and the objective function value shows the minimum cost. The linear programming problems for both technical and cost efficiency models have been solved using Excel Solver 2010 and VB macro.

There are no universally defined inputs or outputs of banks. Owing to the ambiguity regarding the purpose and functions of banks in an economy, diversity in financial products and services provided by banks, there have been controversies and alternate approaches in the literature regarding specification of banking inputs and outputs. This study considers Indian commercial banks primarily as financial intermediaries. Therefore the "intermediation approach" of input/output specification for banks has been adopted here. Inputs have been selected to capture both labor and capital components of bank inputs. Output variables have been selected considering both the traditional lending and recently growing non-lending activities of banks. So, we have,

Inputs:i) number of employees, ii) equity capital (core capital + reserves & surpluses), iii) deposits;

Outputs: i) advances, ii) investments, iii) non-interest income.

For the estimation of cost efficiency scores, we have defined the input prices as follows. Price of labor is the total expenditure on employees divided by the number of employees. Cost of the fund is defined as per unit interest on deposits and borrowings. Cost of capital is defined as the expenditure on non-labor inputs divided by the total fixed asset.

EMPIRICAL FINDINGS

Following the methodologies discussed in the previous section, technical efficiencies and cost efficiencies of all scheduled commercial banks of India have been estimated for the time period 2006-2016. To assess the connection between bank size and bank efficiency, quartile assessment technique has been applied. Applying this method, we get four

bank groups according to their size (measured by log value of the total asset or total number of branches) for each year, first quartile group to be the smallest banks and fourth quartile group to be the largest banks. Table 1and following diagrams demonstrate the relationship between bank size (measured by the log value of the total asset of the banks) and their technical and cost efficiencies.

Table 1: Mean Efficiency of Different Bank Groups According to (log) Asset Size

	Mean Technical Efficiency				Mean Cost Efficiency			
	First Quartile	*Second Quartile*	*Third Quartile*	*Fourth Quartile*	*First Quartile*	*Second Quartile*	*Third Quartile*	*Fourth Quartile*
2006	0.428	0.524	0.587	0.651	0.690	0.621	0.685	0.720
2007	0.577	0.655	0.598	0.633	0.703	0.768	0.740	0.779
2008	0.530	0.680	0.639	0.722	0.693	0.776	0.769	0.834
2009	0.474	0.624	0.613	0.725	0.635	0.741	0.789	0.852
2010	0.598	0.654	0.626	0.745	0.732	0.806	0.831	0.889
2011	0.627	0.726	0.583	0.703	0.729	0.834	0.785	0.867
2012	0.627	0.701	0.655	0.746	0.724	0.825	0.867	0.921
2013	0.523	0.744	0.690	0.784	0.675	0.845	0.860	0.931
2014	0.578	0.616	0.725	0.788	0.725	0.785	0.880	0.924
2015	0.577	0.674	0.717	0.744	0.761	0.796	0.868	0.900
2016	0.582	0.653	0.646	0.776	0.732	0.776	0.826	0.911

Source: Author's calculation

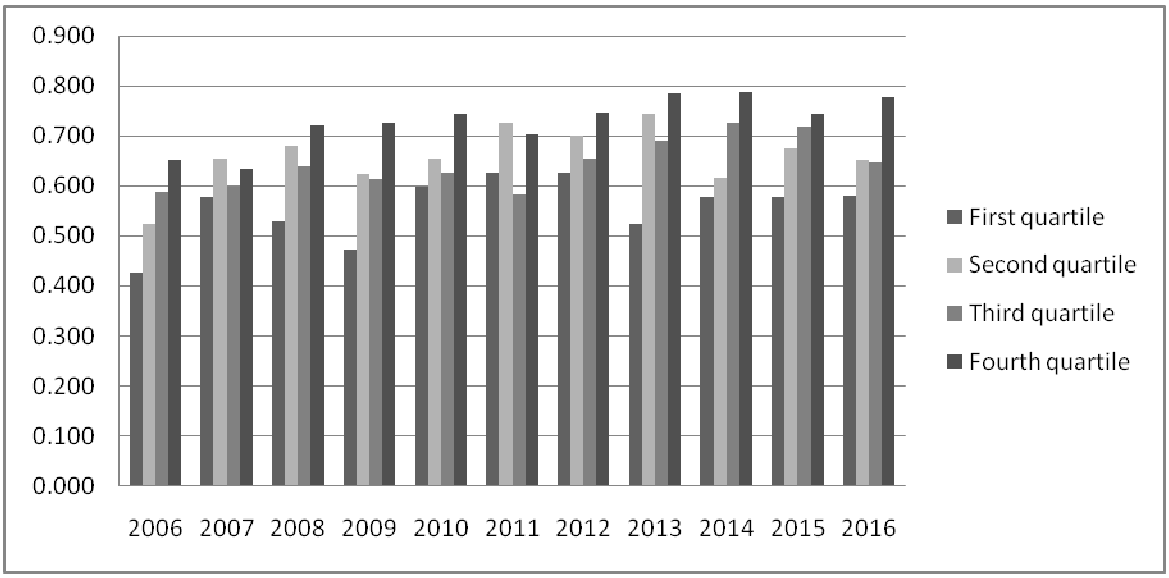

Figure 1: Mean Technical Efficiency of Different Bank Groups According to Asset Size

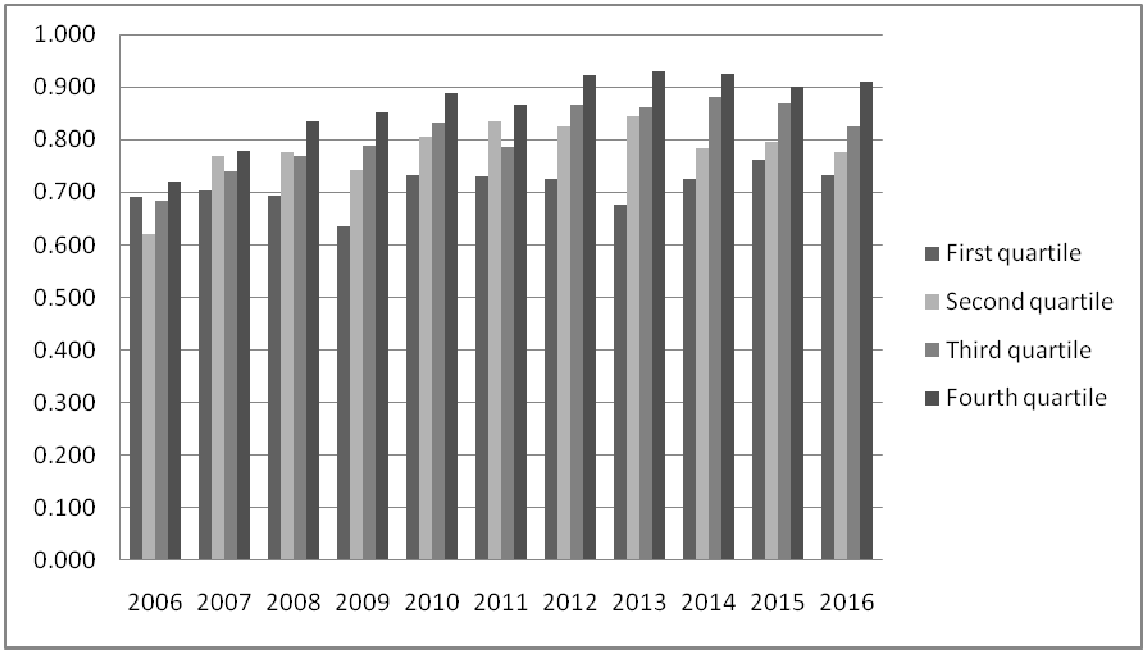

Figure 2: Mean cost efficiency of different bank groups according to asset size

The above table and diagrams suggest that with some minor exceptions in the earlier years, there is a fairly positive relation between bank size (measured by the proxy variable "total asset") and efficiency of banks. This is true for both technical Efficiency and Cost Efficiency of banks measured by DEA. This trend is more prominent in recent years. In the initial years, this positive association is not very conclusive. In those years, the medium-sized banks were performing better. But with time, the scenario is changed and the largest banks or the banks in the fourth quartile group give the highest mean technical and cost efficiency scores. Further studies on this may reveal a non-linear relationship between efficiency and size of Indian banks.

As mentioned earlier, we have taken two different proxy variables for bank size – total asset and number of branches; let us now find out whether the above result is true when the number of branches is considered as a variable for bank size.

Table 2: Mean Efficiency of Different Bank Groups According to No. of Branches

	Mean Technical Efficiency				Mean Cost Efficiency			
	First Quartile	*Second Quartile*	*Third Quartile*	*Fourth Quartile*	*First Quartile*	*Second Quartile*	*Third Quartile*	*Fourth Quartile*
2006	0.500	0.553	0.641	0.497	0.723	0.688	0.716	0.598
2007	0.716	0.551	0.669	0.482	0.765	0.724	0.795	0.685
2008	0.668	0.655	0.685	0.543	0.754	0.785	0.804	0.713
2009	0.549	0.634	0.650	0.591	0.660	0.757	0.817	0.759
2010	0.658	0.731	0.621	0.651	0.759	0.840	0.829	0.834
2011	0.741	0.673	0.604	0.611	0.842	0.765	0.789	0.819
2012	0.718	0.694	0.620	0.678	0.809	0.783	0.846	0.891
2013	0.613	0.726	0.678	0.730	0.744	0.812	0.856	0.905
2014	0.790	0.824	0.829	0.909	0.790	0.824	0.829	0.909
2015	0.847	0.831	0.803	0.899	0.847	0.831	0.803	0.899
2016	0.844	0.740	0.794	0.876	0.844	0.740	0.794	0.876

Source: Author's calculation

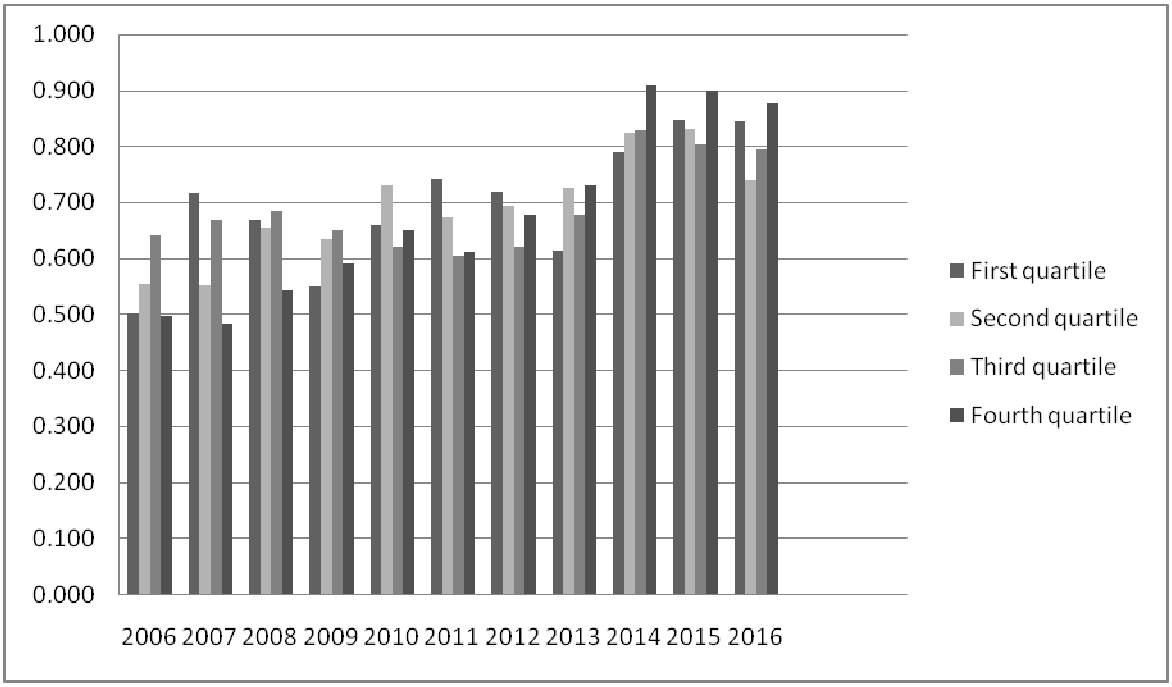

Figure 3: Mean Technical Efficiency of Different Bank Groups According to No. of Branches

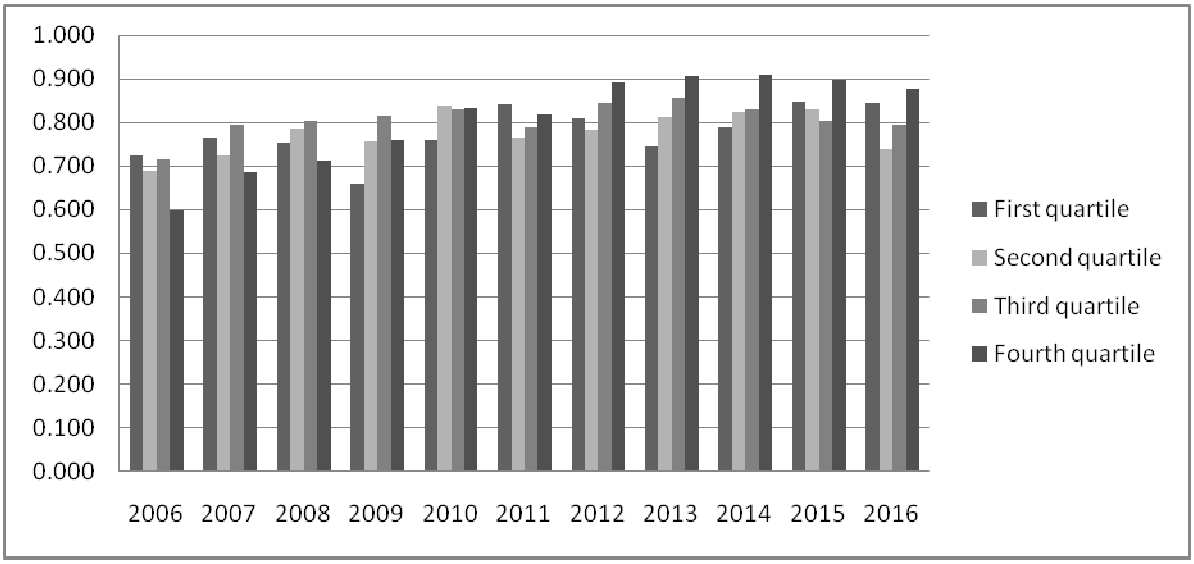

Figure 4: **Mean Cost Efficiency of Different Bank Groups According to No. of Branches**

Table 2 and the following two diagrams reinforce our earlier conclusion. In India, large sized banks are more efficient banks. We have performed the same analysis on the basis of two different efficiency parameters and two different bank size parameters. Nevertheless, our conclusions from all the analyses are reasonably similar.

There may be various factors (like ownership, capital strength, risk factors, etc.) leading to this outcome. However, in a country like India where the economy was once considerably closed with substantial state intervention but now gradually opening to the global economy and liberal economic policies, the ownership structure of any service provider is an important factor affecting the efficiency or other performance indicators profusely. The indian banking system is a classic example of co-existence of the public sector and private sector banks. We cannot deny the possibility

that the ownership structure of a bank might have affected both its size and efficiency. The next two tables show the number of banks from the public sector, domestic private sector and foreign ownership in four quartile groups of our study.

Table 3: Ownership-Wise Number of Banks in Four Quartiles According to (log) Asset Size

	First Quartile			Second Quartile			Third Quartile			Fourth Quartile		
	PUB	***PVT***	***FRN***	***PUB***	***PVT***	***FRN***	***PUB***	***PVT***	***FRN***	***PUB***	***PVT***	***FRN***
2006	0	3	18	0	15	6	12	6	3	16	3	2
2007	0	5	15	0	11	10	14	6	1	14	3	3
2008	0	4	15	1	11	7	14	4	2	13	3	3
2009	0	3	16	0	11	8	14	5	2	13	2	2
2010	0	2	17	0	11	8	12	6	2	15	3	2
2011	0	2	17	0	8	12	10	8	2	16	3	1
2012	0	0	20	0	9	11	10	8	3	16	3	1
2013	0	0	21	0	8	13	9	9	4	17	3	0
2014	0	0	21	0	8	14	8	8	7	18	3	1
2015	0	0	21	0	7	15	7	9	6	19	3	0
2016	0	0	21	0	8	15	9	8	5	17	5	0

Source: Author's calculation

Table 4: Ownership-Wise Number of Banks of in Four Quartiles According to the Number of Branches

	First Quartile			Second Quartile			Third Quartile			Fourth Quartile		
	PUB	***PVT***	***FRN***	***PUB***	***PVT***	***FRN***	***PUB***	***PVT***	***FRN***	***PUB***	***PVT***	***FRN***
2006	0	1	20	0	8	13	7	14	0	20	0	0
2007	0	1	20	0	12	7	7	13	0	20	0	0
2008	0	1	19	0	11	7	9	10	0	18	1	0
2009	0	1	19	0	10	8	8	10	0	18	2	0
2010	0	1	18	0	9	11	9	11	0	17	2	0
2011	0	1	20	0	8	11	9	10	0	16	3	0
2012	0	0	21	0	6	13	8	12	0	17	3	0
2013	0	0	23	0	5	14	8	13	0	17	3	0
2014	0	0	25	0	3	16	7	15	0	18	3	0
2015	0	0	24	0	3	16	7	14	0	18	3	0
2016	0	0	24	0	3	16	8	14	0	17	4	0

Source: Author's calculation

The above two tables show that in the first two quartile groups or the small bank groups, there are mostly foreign banks, few domestic private sector banks, and no public sector banks. In the third quartile group, there are few Indian private banks and some public sector banks. In the last quartile or largest bank group, there are mostly public sector banks. This trend is true for both cases – the size of banks measured by total asset and that measured by the total number of branches. Hence, we can come to a conclusion that the large banks in India are mostly public sector banks except a few domestic private and foreign banks like ICICI or IDBI or Standard Chartered Bank. This result is even more noticeable in the second case. In table 4, most of the public sector banks are in the largest bank group implying the public sector banks are not only more efficient but also more successful in expanding branches following the policy of "financial inclusion" than their domestic private and foreign counter parts.

CONCLUDING REMARKS

The above discussion regarding the relationship between bank size measured by the number of branches and technical and cost efficiencies comes to an inference that the larger banks in India are better performing or more efficient banks. There may be several factors causing this outcome. The reason might be that in India, the larger banks have

succeeded to reap the benefits of economic reforms and financial liberalization and they also have advantages of scale and scope as argued by conventional economic theories. If this is true, then the contemporary banking policy of "financial inclusion" which prerequisites geographical and financial expansion would be beneficial in two ways. In one hand, this policy will bring more financially unprivileged or unbanked people under the canopy of the formal banking system. On the other hand, branch expansion and increase in the scale of operation will automatically improve their efficiency with time. Therefore there is no contradiction between the social goals of banking like "financial inclusion" and business goals of banking like operational efficiency. This may end the perpetual dilemma of Indian public sector banks. The study further reveals that the public sector banks of India are performing more efficiently than the banks of other ownership structure in spite of their gigantic size and extra responsibility of participating in the "financial inclusion" policy initiative. Even after a quarter century of financial liberalization, the public sector banks have not lost their relevance. Instead, they have now become more viable and sustainable functioning towards fulfilling the dream of "inclusive India".

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